Section 955

PRICE REDUCTION FORMULAS FOR NON SPECIFICATION BITUMINOUS MATERIALS

955.01 Scope

Mathematical price reduction formulas are presented below for various bituminous materials not within strict compliance with specifications, but which may be accepted by the project engineer at a reduced price.

Example	USING FORMULA	Specifications	Test Results	Difference	% Reduc-tion Per Unit	Total % Reduc-tion
1	55 SS Emulsion Viscosity @ 77 EF, sfs	20-100	16	-4	5.0	20.0
2	28 MC & SC-70 Viscosity @ 140 EF, cSt	70-140	55	-15	0.6	9.0
3	12 AC-20 Viscosity @ 140EF, P	1600-2400	2580	+180	0.25	45.0
4	10 AC-10 Ductility @ 39.2 EF, cm	15 min	9	-6	6.66	39.96
5	8 AC-10 Viscosity @ 275EF, cSt	250 min	200	-50	0.40	20.0
6	6 AC-10 Viscosity @ 140 EF, P	800-1200	700	-100	0.25	25.0

Since Reductions are cumulative, assuming examples 5 and 6 reductions were on the same sample, total reduction would be 20.0% plus 25.0% equals 45.0%.

Price reductions will be assessed on the number of tons of bituminous material represented by the sample. To determine the total price reduction, use the formula:

(Percent price reduction) X (Price per ton[1]) X Number of tons represented by the sample)

[1] Use the contract asphalt bid item or the contractor's invoice price per ton including freight to the mix site, which ever is the greater amount.

Before reductions in payment are assessed for failure to meet specifications, the following test tolerances shall be applied:

ASPHALT CEMENT & POLYMER MODIFIED

(Metric units are the proper convention for the following)

Viscosity @140 EF, P	7.0%
Viscosity @ 275 EF, cSt	8.8%
Penetration @ 77 EF, 0.1 mm	
Below 50	4 units
Above 50	8.0%
Penetration @ 39.2 EF, 0.1 mm	21.3%
Ductility @ 39.2 EF, cm	20.0%
Toughness @ 77 EF, in-lb	18.2%
Tenacity @ 77 EF, in-lb	20.0%
Softening Point, EF	3.4%
Tests on Residue (RTFO)	
Viscosity @ 140 EF, P	7.0%
Ductility @ 39.2 EF, cm	20.0%
RTFO mass loss, %	16.0%
Softening Point, EF	3.4%

Rejuvenation Agents
Tests on residue from Distillation

Saturates (ASTM D2007)	4.0%
Aromatics (ASTM D2207)	3.3%

Examples

From formula 2 AC-5 Viscosity @ 140 EF, P
Testing Tolerance Test

Specification	Tolerance	Range	Results	Difference	%Reduction
400-600	7.0%	370-640	640	+40	0.0

From formula 10 AC-10 Ductility @ 39.2 EF, cm

15 Min.	20%	12 Min.	13	-2	0.0

LIQUID ASPHALTS

Viscosity @ 140 EF:

Below 3000, cSt	3.0%
3000-6000, cSt	9.0%
Above 6000, cSt	10.0%

Distillation:

To 347EF	3.5%
Above 347 EF	2.0%
Residue, Volume	2.0%

Test on Residue:

Viscosity @ 140 EF, P	3.0%

Examples

From formula 28 RC, SC & MC-70 Viscosity @ 140 EF, cSt

Specifications	Tolerance	Range	Results	Difference	%Reduction
70-140	3.0%	68-144	68	-2	0.0

From formula 24 MC-70 Residue Viscosity @ 140 EF, P

300-1200	3.0%	290-1240	290	-10	0.0

From formula 34 RC-3000 Viscosity @ 140 EF, cSt

3000-6000	9.0%	2730-6540	2730	-270	0.0

EMULSIFIED ASPHALTS

Viscosity, Saybolt		
20-100 @ 25 EC	sfs	15.0%
75-400 @ 50 EC	sfs	20.0%
>400 @ 60 EC	sfs	20.0%

Examples
From formula 55 SS Emulsion @ 77 EF, sfs
Testing Tolerance Test

Specifications	Tolerance	Range	Results	Difference	%Reduction
20-100	15.0%	17-115	18	-2	0.0

Note: X = actual reported test result

Grade AC-5 Asphalt Cement

Viscosity @ 140 EF, P
Specification Limits (400-600)
Testing Tolerance Limits (370-640)
Price Adjustment = 0.5(400-X) for X < 370 Formula 1
or 0.5(X-600) for X > 640 Formula 2

Viscosity @ 275 EF, cSt
Specification Limits (at least 175)
Testing Tolerance Limits > 160
Price Adjustment = 0.5(175-X) for X < 160 Formula 3

Penetration @ 77EF, 0.1 mm
Specification Limits (at least 140)
Testing Tolerance Limits > 129
Price Adjustment = 0.67(140-X) for X < 129 Formula 4

Ductility @ 39.2 EF, cm
Specification Limits (at least 25)
Testing Tolerance Limits > 20
Price Adjustment = 4(25-X) for X < 20 Formula 5

Grade AC-10 Asphalt Cement

Viscosity at 140EF, P
Specification Limits (800-1200)
Testing Tolerance Limits (740-1280)
Price Adjustment = 0.25(800-X) for X < 740 Formula 6
or 0.25(X-1200) for X > 1280 Formula 7

Viscosity at 275 EF, cSt
Specification Limits (at least 250)
Testing Tolerance Limits > 228
Price Adjustment = 0.40(250-X) for X < 228 Formula 8

Penetration at 77 EF, 0.1 mm
Specification Limits (at least 80)
Testing Tolerance Limits > 74
Price Adjustment = 1.0(80-X) for X < 74 Formula 9

Ductility at 39.2 EF, cm
Specification Limits (at least 15)
Testing Tolerance Limits > 12
Price Adjustment = 6.66(15-X) for X < 12 Formula 10

Grade AC-20 Asphalt Cement

Viscosity at 140 EF, P
Specification Limits (1600-2400)
Testing Tolerance Limits (1490-2570)
Price Adjustment = 0.25(1600-X) for X < 1490 Formula 11
or 0.25(X-2400) for X > 2570 Formula 12

Viscosity at 140 EF (AC-20P), P
Specification Limits (at least 180)
Testing Tolerance Limits > 167
Price Adjustment = 0.17(1800-X) for X < 1670 Formula 13

Viscosity at 275 EF, cSt
Specification Limits (at least 300)
Testing Tolerance Limits >274
Price Adjustment = 0.34(300-X) for X <274 Formula 14

Penetration at 77 EF, 0.1mm
Specification Limits (at least 60)
Testing Tolerance Limits > 55
Price Adjustment = 1.5(60-X) for X < 55 Formula 15

Ductility at 39.2 EF, cm
Specification Limits (at least 5)
Testing Tolerance Limits > 4
Price Adjustment = 20(5-X) for X < 4 Formula 16

Ductility at 39.2 EF , (AC-20P), cm
Specification Limits (at least 50)
Testing Tolerance Limits > 40
Price Adjustment = 4(50-X) for X <50 Formula 17

Ductility at 39.2 EF after RTFO (AC-20P), cm
Specification Limits (at least 25)
Testing Tolerance Limits > 20
Price Adjustment = 4(25-X) for X < 20 Formula 18

Toughness (AC-20P) , in-lb
Specification Limits (at least 110)
Testing Tolerance Limits >90

Price Adjustment = 1.67(110-X) for X < 90 Formula 19

Tenacity (AC-20P), in-lb
Specification Limits (at least 75)
Testing Tolerance Limits >60
Price Adjustment =2.22(75-X) for X <60 Formula 20

PBA-50 Graded Asphalt Cement

Softening Point, EF
Specification Limits (at least 145 EF)
Testing Tolerance Limits > 140 EF
Price Adjustment =2.4(145-X) for X < 140 Formula 21

Viscosity @140 EF, P
Specification Limits (at least 5000)
Testing Tolerance Limits > 4650
Price Adjustment = 0.065 (5000 - X) for X < 4650 Formula 22

Toughness, in-lb (same as AC-20P)
Tenacity, in-lb (same as AC-20P)

Penetration @ 39.2 EF, 0.1 mm
Specification Limits (at least 35)
Testing Tolerance Limits > 27
Price Adjustment = 1.5 (35-X) for X < 27 Formula 23

Cut-Back Liquid Asphalts

Residue Viscosity @ 140 EF, MC, all grades, P
Specification Limits (300-1200)
Testing Tolerance Limits (290-1240)
Price Adjustment = 0.136(300-X) for X < 290 Formula 24
or 0.136(X-1200) for X > 1240 Formula 25

Residue Viscosity @ 140 EF RC, all grades, P
Specification Limits (600-2400)
Testing Tolerance Limits (580-2470)
Price Adjustment = 0.068(600-X) for X < 580 Formula 26

or 0.068(X-2400) for X > 2470 Formula 27

Viscosity @ 140 EF, MC-RC-SC 70, cSt
Specification Limits (70-140)
Testing Tolerance Limits (68-144)
Price Adjustment = 0.6(70-X) for X < 68 Formula 28
or 0.2(X-140) for X > 144 Formula 29

Viscosity @ 140 EF, MC-RC-SC 250, cSt
Specification Limits (250-500)
Testing Tolerance Limits (242-515)
Price Adjustment = 0.2(250-X) for X < 242 Formula 30
or 0.08(X-500) for X > 515 Formula 31

Viscosity @ 140 EF, MC-RC-SC 800, cSt
Specification Limits (800-1600)
Testing Tolerance Limits (776-1648)
Price Adjustment = 0.08(800-X) for X < 776 Formula 32
or 0.02(X-1600) for X > 1648 Formula 33

Viscosity @ 140 EF, RC 3000, cSt
Specification Limits (3000-6000)
Testing Tolerance Limits (2730-6540)
Price Adjustment = 0.02(3000-X) for X < 2730 Formula 34
or 0.006(X-6000) for X > 6540 Formula 35

RC-70 Distillation Fraction to 374 EF
Specification Limits (10 minimum)
Testing Tolerance Limits > 9.65
Price Adjustment = 5.0(10-X) for X < 9.65 Formula 36

RC-70 Distillation Fraction to 437 EF
Specification Limits (50 minimum)
Testing Tolerance Limits > 49
Price Adjustment = 5.0(50-X) for X < 49 Formula 37

RC-70 Distillation Fraction to 500 EF
Specification Limits (70 minimum)
Testing Tolerance Limits > 68.6
Price Adjustment = 5.0(70-X) for X < 68.6 Formula 38

RC-70 Distillation Fraction to 600 EF
Specification Limits (85 minimum)
Testing Tolerance Limits >83.3
Price Adjustment = 5.0(85-X) for X < 83.3 Formula 39

MC-70 Distillation Fraction to 437 EF
Specification Limits (0-20)
Testing Tolerance Limits < 20.4
Price Adjustment = 5.0(X-20) for X > 20.4 Formula 40

MC-70 Distillation Fraction to 500 EF

Specification Limits (20-60)
Testing Tolerance Limits (19.6-61.2)
Price Adjustment = 5.0(20-X) for X < 19.6 Formula 41
or = 5.0(X-60) for X > 61.2 Formula 42

MC-70 Distillation Fraction to 600 EF
Specification Limits (65-90)
Testing Tolerance Limits (63.7-91.8)
Price Adjustment = 5.0(65-X) for X < 63.7 Formula 43
or 5.0(90-X) for X > 91.8 Formula 44

MC-250 Distillation Fraction to 437 EF
Specification Limits (0-10)
Testing Tolerance Limits < 10.2
Price Adjustment = 5.0(X-10) for X > 10.2 Formula 45

MC-250 Distillation Fraction to 500 EF
Specification Limits (15-55)
Testing Tolerance Limits (14.7-56.1)
Price Adjustment = 5.0(15-X) for X < 14.7 Formula 46
or 5.0(X-55) for X > 56.1 Formula 47

MC-250 Distillation Fraction to 600 EF
Specification Limits (60-87)
Testing Tolerance Limits (58.8-88.7)
Price Adjustment = 5.0(60-X) for X < 58.8 Formula 48
or 5.0(X-88.7) for X > 88.7 Formula 49

MC-800 Distillation Fraction to 500 EF
Specification Limits (0-35)
Testing Tolerance Limits < 35.7
Price Adjustment = 5.0(X-35) for X > 35.7 Formula 50

MC-800 Distillation Fraction to 600 EF
Specification Limits (45-80)
Testing Tolerance Limits (44.1-81.6)
Price Adjustment = 5.0(45-X) for X < 44.1 Formula 51
or 5.0(X-80) for X > 81.6 Formula 52

SC-800 Distillation Fraction to 680 EF
Specification Limits (2-12)
Testing Tolerance Limits (1.96-12.24)
Price Adjustment = 5.0(2-X) for X < 1.96 Formula 53
or 5.0(X-12) for X > 12.24 Formula 54

Emulsified Asphalt

SS1, SS1h, CSS-1, CSS-1h Emulsion Viscosity @ 77 EF, sfs
Specification Limits (20-100)
Testing Tolerance Limits (17-115)
Price Adjustment = 5(20-X) for X < 17 Formula 55

or 1.0(X-100) for X > 115 Formula 56

Residue by Evaporation (CSS-1,CSS-1h,SS-1, SS-1h)
Specification Limits (57 min)
Testing tolerance Limits > 56.54
Price Adjustment= 5.0(57-X) for X < 56.54 Formula 57

Chip-Seal Emulsions

CRS-2A,B Emulsion Viscosity @ 122 EF, sfs
Specification Limits (140-400)
No Testing Tolerances Allowed
Accepted or rejected at project site

CRS-2P Emulsion Viscosity @ 140 EF, sfs
Specification Limits (100-400)
No Testing Tolerances Allowed
Accepted or rejected at project site

LMCRS-2 Emulsion, Viscosity @ 122 EF, sfs
Specification Limits (75-300)
No Testing Tolerances Allowed
Accepted or rejected at project site

HFRS-2P Emulsion, Viscosity @ 122 EF, sfs
Specification Limits (50-450)
No Testing Tolerances Allowed
Accepted or rejected at project site

Residue by Evaporation CRS-2, CRS-2A, CRS-2B , HFCRS-2P Specification Limits (65 minimum)
Testing Tolerance Limits > 64.48
Accepted or Rejected at project site

Residue by Evaporation, CRS-2P , (68 minimum)
Testing Tolerance Limits >67.46
Accepted or Rejected at project site

Performance Graded Asphalt Binders

(The PG grading system is tied to metric temperatures, i.e, PG 64-34 is 64 EC and 34 EC)

Mass Loss, PG grades and AC-20P
Specification Limits (1.0 maximum)
Testing Tolerance Limits < 1.16

Price Adjustment = 200(X-1.0) for X > 1.16 Formula 58

Deviations from specified PG grade:

If the difference on the high or low side does not exceed 1E C, then no penalties are assessed. the penalties are applied on the sum of the degrees out of specification minus 1 EC. Exceeding the specification on one side does not compensate for shortfalls on the other side.

Example:

Spec Grade:	PG70-22	Penalty Range (PR)	Penalty
Sample 1:	69.4-21.8	=(0.6+0.2)-1=-0.2	No
Sample 2:	70.4-19.8	=(0+2.2)-1 = 1.2	Yes
Sample 3:	69.4-19.8	=(0.6+2.2)-1= 1.8	Yes

The Price Adjustment (percent) is a function of the penalty range, PR.
No price adjustment will be made on cumulative differences smaller than 1 EC.

Price Adjustment (%) = 5.83 (PR) + 0.83 (PR^2) Formula 59

Penalty ranges (PR) greater than 8 EC warrant removal.